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N U R S I N G
S E C T I O N

Use of distilled white vinegar dressing supplemental to oral antibiotics in the management of *Pseudomonas aeruginosa* exit site infection in continuous ambulatory peritoneal dialysis patients

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Abstract

Pseudomonas aeruginosa infected peritoneal catheter exit sites have been a troublesome problem among patients on continuous ambulatory peritoneal dialysis (CAPD). P. aeruginosa is characterized by its versatility and ability to colonize even in water with minimum nutrients. This is a retrospective report on the experience of attempts to control the growth of the microbe by altering the acidity of the habitat environment using diluted distilled white vinegar (pH 3). All patients were also treated with oral ciprofloxacin. This regimen achieved 97% eradication with no relapse. The application of vinegar dressing for P. aeruginosa infected peritoneal catheter exit sites was found to achieve an apparently higher eradication and a lower relapse rate when compared with historical controls using chlorhexidine or Eusol dressings. Further prospective study is required to confirm the effectiveness of such regimen.

Key words: Continuous ambulatory peritoneal dialysis (CAPD), Exit site infection (ESI), Pseudomonas aeruginosa, Vinegar

中文摘要

綠膿桿菌對腹膜透析管皮膚出口感染是連續性家居腹膜透析（CAPD）病人的一個棘手的問題。綠膿桿菌的特徵是易變性和在低營養的水中繁殖的能力大。現報道使用稀釋的過濾白醋(pH3)酸化局部環境以便抑制該微生物生長。使用白醋敷裹處理綠膿桿菌感染的透析管出口辦法比使用洗必太或優蘇能夠更有效且複發率低。

INTRODUCTION

Exit site infection (ESI) has been a troublesome problem among patients on continuous ambulatory peritoneal dialysis (CAPD). Its definition, classification, choice of antibiotic, treatment duration and timing for surgical intervention are still controversial. However, it is established that infections at the peritoneal catheter exit site may contribute to many complications, including tunnel infection, peritonitis and catheter loss, which may ultimately require a change of treatment modality to hemodialysis. One of the causative organisms for ESI is *Pseudomonas aeruginosa*. This organism is characterized by its versatility and its ability to colonize in water with minimal nutrients, as well as its ability to survive and multiply over a broad temperature range of 20 ^{o}C to 42 ^{o}C (1). *P. aeruginosa* infected exit sites are not uncommon in patients undergoing CAPD. It has been reported that 10% to15% of ESI are infected with *P. aeruginosa*. Research has suggested that this may be related to the fact that *Pseudomonas* is a water-borne bacterium that could invade the exit site during bathing (2). It has been reported that *P. aeruginosa* ESI often require catheter removal, although in a recent study, treatment with oral ciprofloxacin 500 mg BD and local

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care resolved the infection in the majority of patients (3).

From 1993 to 1997 in Tuen Mun Hospital, ESI is defined in accordance with the cardinal signs of inflammation: heat, redness, swelling and pain, in addition to the features specific for an exit of any skin-penetrating foreign body: purulent drainage, and regression of epidermis with or without exuberance of granulation tissue. Before a positive culture is confirmed, 0.05% aqueous chlorhexidine is used to cleanse infected exits. eusol (chlorinated solution of Lime and Boric acid solution) is the other cleansing solution of choice for exit sites with purulent discharge. A course of oral antibiotics is prescribed according to sensitivity results. A retrospective study of the 168 cases of ESI encountered during the period from May 1993 to August 1997 (4095 patient-months) revealed 29 patients had PA infection (17%). The mean age of the PA infected group was 53 ±11.4 and the mean duration of CAPD treatment was 13.4 ±8.8 months. Nine of these patients were diabetics. They were all treated with ciprofloxacin 500 mg P.O. BD unless sensitivity results suggested otherwise. Ten patients had a relapse of ESI despite adequate treatment. Two of these patients were diabetic. Three patients eventually developed tunnel infection and required catheter removal at 4 to 11 months of initial infection. The mean duration of treatment to achieve eradication of the infection was 9.8 ±7.1 weeks.

Vinegar

A new nursing practice was introduced in our renal unit with the aim to improve the outcome of PA ESI. When we choose a cleansing agent, a non-irritating solution is important (4). Environmental factor is essential for the growth of microorganisms. Most bacteria demand specific temperature for growth and they tend to grow best at a pH of 6 to 8. Thus, an exit cleansing agent that has a low pH, is non-irritating to the skin and does not damage the peritoneal catheter is ideal. It has been found that diluted (1:1) distilled white vinegar solution was effective in the treatment of both gram-negative bacterial wound infections and PA infected peritoneal catheter exit sites (5-7). The acetic acid used can be made from inexpensive distilled white vinegar (5% acetic acid, Heinz Co. USA) (8), available in local supermarkets, that can be diluted with sterile water for injection in 1:1 ratio. The pH of the final solution is 3, as compared to 7 for 0.05% chlorhexidine and 5 for Eusol. In order to exclude the possible risk of the solution causing catheter damage, peritoneal catheters were immersed in either vinegar solution or 0.05% chlorhexidine for 7 days. There was no visible distortion or destruction of the catheters and no demonstrable leakage. All sample swabs taken from the vinegar container for culture yielded no growth.

Vinegar dressing protocol

The usual dressing technique is used where sterile applicator swabs are used in the from-inside-outwards direction to clean the exit site, removing crusts and debris. The exit site is air-dried before the application of a piece of sterile gauze dressing. Vinegar dressing is to be performed twice daily. Patients with PA ESI were followed-up by their named nurses. A 2-week course of ciprofloxacin 500 mg P.O. BD would be given unless sensitivity results suggested otherwise. The named nurse would closely follow the progress until the resolution of ESI. The techniques of bathing, exit site care and exit site dressing were reassessed. The change to the use of vinegar dressing was explained to the patient and consent was obtained. The nurse prepared the solution by diluting white vinegar with sterile water for injection (1:1) aseptically in an autoclaved 30 mL Pyrex bottle for 1-day use. At the end of every 2 weeks: 1. If the exit site was still wet with erythema, a swab would be taken for culture while vinegar was continued; 2. If the exit site became dry but erythema persisted, vinegar was continued; 3. If it became dry without erythema, vinegar would be discontinued. The patient would then be phone-contacted once every 2 weeks for 1 month to track the exit site condition after successful treatment of the ESI.

METHOD

During the period from January 1998 to December 1999 (5442 patient-months), all CAPD patients with PA ESI were recruited to use vinegar dressing when ESI persisted

Table 1. Outcomes of PA ESI with Chlorhexidine/Eusol dressing and vinegar dressing.

	Chlorhexidine/Eusol Dressing May 93 - Aug 97 (n = 29)	Vinegar Dressing Jan 98 - Dec 99 (n = 38)
Sex (M:F)	19:10	15:23
Age (yr)	53.0 ±11.3	48.9 ±14.4
Dialysis duration (mo)	13.4 ±8.8	14.8 ±15.8
Renal disease (DM:non-DM)	9:20	13:25
Duration of treatment till eradication (wk)	9.8 ±7.1	5.1 ±2.8
Number of patients eradicated	26 (89%)	37 (97%)
Number of patients relapsed	10	0
Number of diabetic patients relapsed	3	0

despite having been empirically on chlorhexidine 0.05% or eusol dressing. All patients were followed-up by one of three named nurses (DL, WM, EY).

Relapse of ESI was defined as recurrence of ESI by the same organism within 4 weeks after completion of antibiotics. The infection was defined as unresolved when the positive culture and clinical signs persisted.

RESULTS

Results are shown in table 1. Thirty-eight patients with PA ESI used vinegar dressing. There were 15 male and 23 female patients. The mean age of the patients was 48.9 ±14.4 (range 20-75), and the mean duration of CAPD treatment was 14.8 ±15.8 (range 0-36) months. Thirteen were diabetic. All patients tolerated and accepted the solution and commented on the solution as non-irritating. No skin irritation was noted and no catheter damage was detected. Thirty-seven patients (96%) were cured with no relapse of ESI after successful treatment. Three patients required catheter removal: one male non-diabetic patient with unresolved ESI developed PA peritonitis at 14 weeks and required catheter removal; a female patient developed acne over the face and body when she was receiving androgenic hormones, then a purulent discharging acne was formed at the skin surface over the catheter tunnel at the third week after the exit site had become dry; a third patient had catheter removal for subcutaneous leaks, unrelated to the infection. The infection was eradicated in all 13 diabetic patients. The mean duration of vinegar dressing was 5.1 ±2.8 weeks.

DISCUSSION

The main aims of wound care are to promote wound healing by appropriate integration with medical intervention, to monitor progress of wound healing, and to achieve the desired dry and clean healthy feature of the wound. It is for these reasons that we tried vinegar dressing in the management of PA ESI. The present study on PA ESI revealed that the use of vinegar may shorten the duration of therapy and reduce the relapse rate of infection. The effort that the patients have made in complying to the continuous self-healthcare is also undeniable. While we are increasingly more cost-conscious, the cost implication of relapsing ESI is significant and the use of an inexpensive agent like distilled white vinegar deserves further studies on its microbiological action and clinical effects.

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